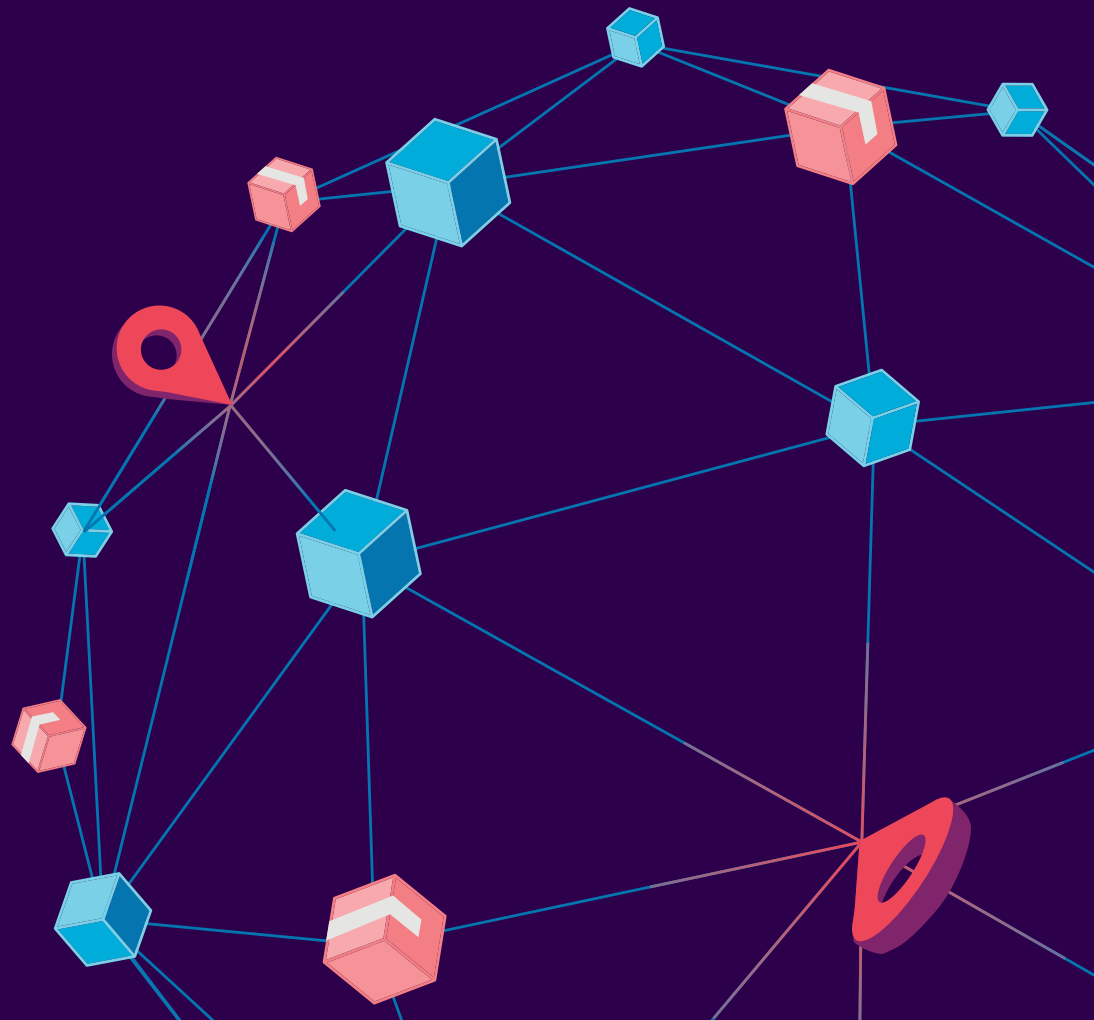


The value of a **blockchain-enabled** supply chain

A series of papers on how blockchain technology can be leveraged to foster the creation of reliable, sustainable, and frictionless supply chains models.





Executive Summary



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Even in normal times, managing supply chains had become a significant challenge. Layers of complexity that had evolved organically often contributed to inefficiency and heightened risk. The current pandemic has brought these difficulties into sharp focus, highlighting the limits of supply chains across industries and regions.

It's clear that if these challenges are to be tackled effectively, those layers of complexity will need to be replaced with what we at Capgemini call a Frictionless Enterprise model – a smooth and seamless flow of information right across the organization, including collaboration between partners, customers, and obviously, suppliers. Blockchain technology also has a significant role to play, as the articles in this series demonstrate.

In addition to regular challenges and to COVID-related needs, there are also the issues associated with climate change. Regulatory and consumer pressures are leading to demands for more sustainable supply chains. As a result, large companies are making bold commitments to decarbonize their activities, and make their supply chains more resilient and sustainable. To achieve this, they need greater visibility, transparency and control, so they can reduce risk in their operations, and protect brand value. These are just some of the qualities that are inherent in the Frictionless Enterprise model.

Blockchain has key role to play to enable this transformation. It can help organizations to achieve reliability and sustainability in three main areas:

- **Certificate sourcing** – enhancing accountability between supply chain participants, with the ability to collect sustainability certificates directly from the source
- **Deep-tier supply chain** – better connection to deep-tier suppliers to improve visibility and control
- **Carbon tracking** – enabling immutable and tamper-proof reporting of carbon emissions including what is known as Scope 3 (supplier carbon emissions).

The benefits for all parties are substantial, both environmentally and socially. They are significant in business terms, too. For instance, the Business for Social Responsibility organization (BSR) suggests that suppliers who are reducing their carbon footprint could be rewarded through sustainable supply chain finance programs, and could access better financing conditions.

This series of articles takes stock of all this – of perennial supply chain challenges, of the heightened needs created by COVID-19, and of long-term sustainability. It considers the extent to which blockchain technology can be used to overcome these challenges, and to create supply chain models that are more reliable and sustainable.

The Frictionless Enterprise

The Frictionless Enterprise seamlessly connects processes and people, intelligently, as and when needed. It dynamically adapts to your organization's circumstances to address each and every point of friction in your business operations.

At Capgemini, we have applied the Frictionless Enterprise to enhance cohesion across our entire suite of products and services. This enables us to respond rapidly to your changing requirements and deliver your specific business outcomes in a value-focused way.

We implement ways to detect, prevent, and overcome frictions – leveraging our latest thinking, organizational design, and intelligent solutions to achieve our goal of effortless operations.

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How to make blockchain the **game-changer** for the **supply chain**



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Managing a modern supply chain is rather like solving a Rubik's cube. It's multi-faceted, and actions taken in one plane have consequences in others. Keeping track of them all can be difficult.

In fact, supply chain management is, if anything, more complicated than this. Several factors are beyond your control – regulatory changes, for instance – whereas a Rubik's cube simply does what it's told.

In this paper, we're going to look at some of the obstacles that can be encountered in the supply chain, and the degree to which blockchain technology can change the game for the better.



Supply chain challenges

While modern supply chains take advantage of technology in various ways, they still face significant challenges:

- **Complex ecosystem** – global enterprises have gradually developed an intricate web of suppliers and logistics channels, operating at regional, national, and international levels
- **Lack of traceability** – the complexity of the supplier network can make it difficult to pinpoint provenance
- **Lack of responsiveness** – process mismatches within and between individual countries and operating companies can cause delays
- **Lack of visibility** – if processes are mismatched, barcodes may not be enough to keep track of goods in transit
- **Data reconciliation** – different processes are also likely to log data in different ways. This, too, can be a problem
- **Lack of trust** – if systems and processes aren't transparent, there is less chance of a single source of truth around which organizations and their suppliers can congregate

It's the complexity that's at the root of all these challenges. In the past, a company may have had a limited number of preferred suppliers, and it would know what to expect, and whom to call in the event of problems. However, in today's business ecosystems, participants often don't know one another and don't always have the visibility into multi-tiered supply structures, as well as each other's data and activities, which can catalyze exposure to risk. Can they go back to their old practices? No: the markets they serve are too big and too complicated now. Instead, a new way needs to be found to achieve transparency, and to build trust.

Complexity is also an issue in supply chain-related due diligence. It's a time-consuming paper-based process, suffering from inconsistent or missing data, as well as from tight budgets allocated to compliance requirements in areas such as modern slavery, working conditions, foreign bribery, conflict finance, and environmental impacts such as pollution. Building sustainable supply chains has become a strategic objective for many organizations across sectors.

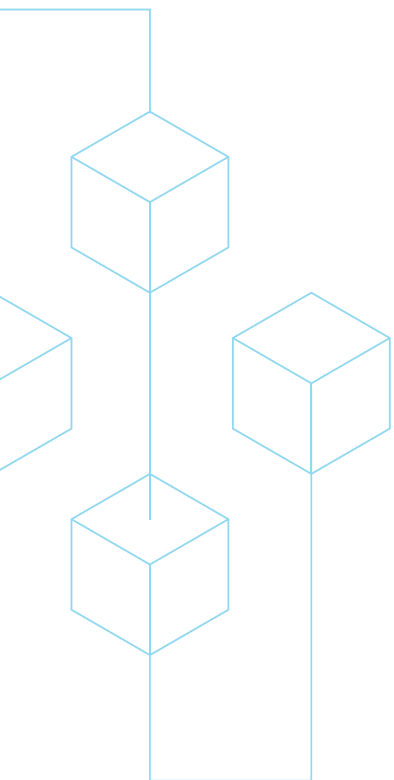
The blockchain principle

Blockchain technology provides a means to address these challenges. It has been described as "[an open, distributed ledger](#) that can record transactions between two parties efficiently, and in a verifiable and permanent way."

Several of the words in that description are crucial:

- **Open and distributed** – it's effectively a database that's shared by all active parties
- **Efficient** – the system can trigger transactions automatically
- **Verifiable** – every record is identified and validated
- **Permanent** – every record is also protected from deletion, tampering, and revision.





Challenges ahead

Right now, organizations are still exploring proofs of concept for blockchain-enabled solutions, taking some of them into production, and are looking to establish networks with like-minded businesses for potential mutual benefit.

Progress, however, has been slow. Enterprises have hesitated for several reasons. For example:

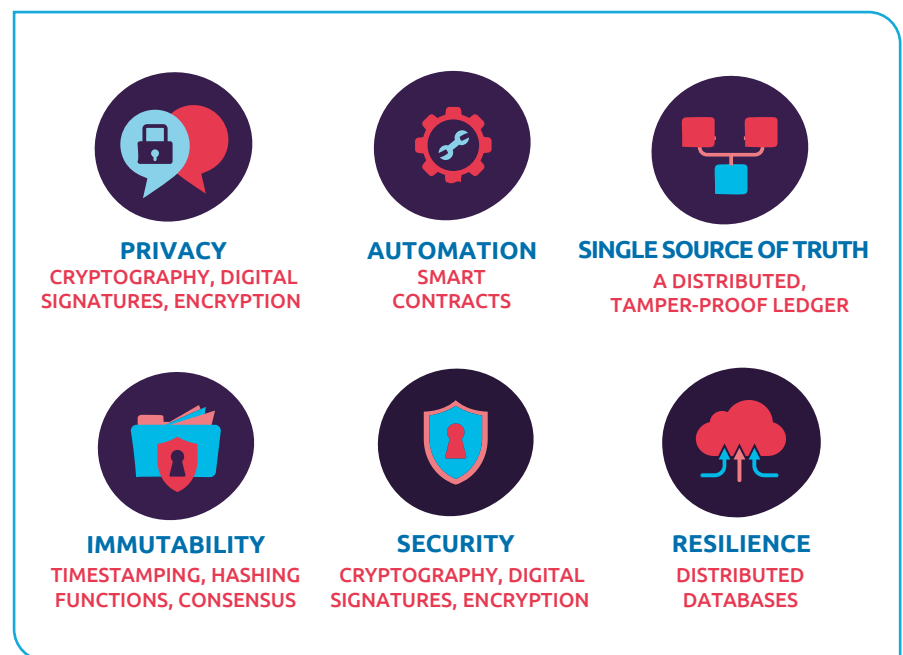
- They have been debating which platform will offer them the best fit in areas such as security, privacy, scalability, integration, and customer experience
- They have been unsure of the regulatory and compliance implications of deployment, and also about questions of ownership and interoperability with other technologies
- They haven't been able to identify their best potential use case, or how comprehensive it should be, and most importantly how to structure the right business case around it
- Nor have they been able to decide whether to make the first move in creating a consortium, or whether to join an existing one
- They have been aware of the extensive communication, interaction, and change management effort needed ahead, which has also put up mental hurdles.

They have several tactical and technological issues to address, including performance and scalability, data governance, enterprise architecture, change management, and business process design

“Organizations are still exploring proofs of concept for blockchain-enabled solutions, taking some of them into production, and are looking to establish networks with like-minded businesses for potential mutual benefit.**”**

Damien de Chillaz
Head of Blockchain & B2B Platforms,
Capgemini's Business Services

Figure 1: The key attributes of blockchain





How blockchain can help

If organizations are able to resolve their questions, they will find that blockchain can make a significant difference to their supply chain operations.

First of all, blockchain's decentralized approach to data management and sharing isn't necessarily more efficient than centralized systems, but it is uniquely able to resolve important issues of trust, visibility, and accountability. It provides a shared and dependable platform for the trusted exchange and referencing of information between organizations that are active in the supply chain.

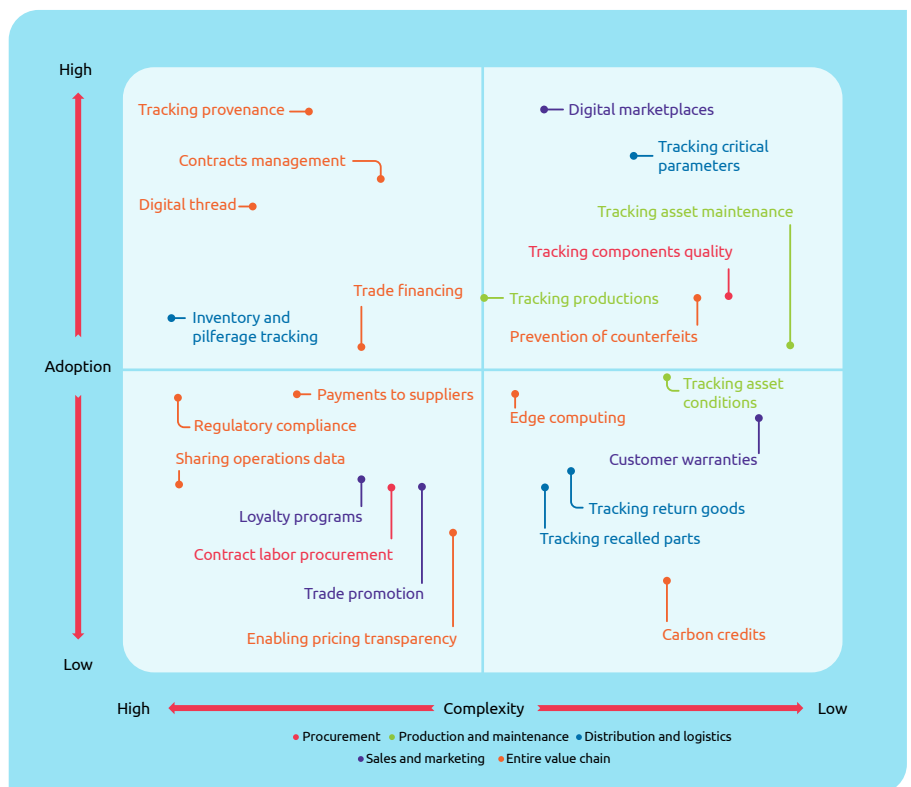
Next, its time-stamping and identification attributes make it easier to automate transactions and repetitive processes such as billing and shipping. This, in turn, facilitates a move to the real-time handling of events.

Blockchain also enables the creation of smart contracts, to ease the burden of several heavy supply chain transactions, such as those involving transfer of ownership or of intellectual property.

What's more, the immutability of the technology means that blockchain provides a single, shared, and tamper-proof source of truth, and hence a verifiable audit trail for all transactions.

Drawing on our cross-industry research, as well as on interviews with experts and startups, we have identified a number of blockchain use cases across the value chain, which we have segmented based on their complexity and adoption levels. They can be seen in the **Figure 2** below.

Figure 2: Blockchain use across the supply chain value chain



“Blockchain provides a shared and dependable platform for the trusted exchange and referencing of information between organizations that are active in the supply chain.”

Sudhir Pai

Chief Technology Officer, Capgemini's Financial Services Services





“Blockchain can play a major role in the enterprise, by catalyzing the emergence of more efficient, reliable, and sustainable supply chains.”

Adrien Calvayrac
France Innovation Ecosystem Lead,
Capgemini AIE Network

The same [Capgemini Research Institute](#) survey identified several benefits that participating organizations anticipated from blockchain projects in the supply chain. Almost nine out of ten respondents (89%) expected to achieve cost savings. Also, just as in a public survey conclusions can be drawn not from detailed responses but from general trends, so with blockchain, the outward identifiers of blocks can be expected to enhance both traceability and transparency. As many as 81% (traceability) and 79% (transparency) of our respondents foresaw these benefits.

How to implement a successful blockchain program

Let's assume an organization has taken a long, hard look at itself. It has acknowledged that it faces several of the challenges articulated earlier in this article, and it recognizes and wants the benefits that blockchain can bring to its supply chain. What are the steps it should take?

In fact, the long, hard look is a step in itself, because first, it establishes the need, and second, it assesses readiness: organizations will have a sense not just of the strengths upon which they can build, but also of the hills they will have to climb.

Next, they should start to develop their strategy. Within the organization, they should attempt to remove as many sources of friction in the supply chain as possible before embarking on the transition to blockchain. At Capgemini, we use the [Digital Global Enterprise Model \(D-GEM\)](#) – our proprietary business transformation platform – to help our clients deliver significant improvements in terms of productivity, performance, scalability, and data governance – and indeed also in terms of enterprise architecture, change management, business process design, and the business case as a whole. remain competitive in a rapidly changing, business context. This, in turn, enables, what we call, [the Frictionless Enterprise](#).

Their strategy also needs to be developed in the context of the environment they occupy – of their market position, and also of their specific supply chain ecosystem. The current approach will not be a one-size-fits-all model – it will be something that has developed over years in response to specific needs. In this respect, at least, the blockchain model will be no different. It will need to be tailored to circumstances, which is why those circumstances need to be thoroughly understood.

Organizations will of course also need to know what success looks like. How will it be measured? Which metrics will be key? What will be the project management milestones for the implementation of technical solution elements including information systems integration, IoT implementation, the incorporation of user apps, and of course the transition to blockchain?

In addition, businesses will need to implement robust security controls from the outset, and especially before scaling up the initiative.

And they will need to define the governance strategy. This is likely to be a collegiate decision, working closely with other parts of the supply chain – and possibly also with other enterprises operating in the same space. The result could be a standard set of principles that the industry and its regulatory bodies will recognize and accept.

The importance of focus

In short, blockchain can play a major role in the enterprise, by catalyzing the emergence of more efficient, reliable, and sustainable supply chains.

But as with so many desirable goals, a little effort and patience are required.

Effort, patience – and focus. Blockchain isn't a buzzphrase, and it isn't a panacea. If organizations truly want it to deliver, they need to keep business impact and value creation in the very front and center of their thinking.





How blockchain can enable next-generation traceability



Adil Hihi
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Blockchain Lead, Capgemini Invent



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In the first paper in this series, we considered some typical supply chain challenges, and the extent to which blockchain technology can address them. In this paper, we will look at one of those challenges in more detail.



“If operational excellence is a regulatory requirement, it’s also being driven by increasingly demanding consumers. People want products to be affordable and immediately available – but there are growing public concerns regarding the origin, quality, and validity of products.”

Adil Hihi

Senior Consultant, Capgemini Invent

The challenge of trust

In a supply chain partnership, trust is usually developed over time between two companies. They learn how the other business does things, and they get used to one another’s paperwork. They also get to know people by name, and if there’s an issue, they know who to call.

Today, however, life is more complicated – and the larger the enterprise at the heart of the supply chain, the more complex things are likely to be. There are more players, and more variables, and not all relationships will be of long standing. As a result, participants often don’t know one another. They lack visibility over each other’s data and activities. All of which means that trust has to be established in another way.

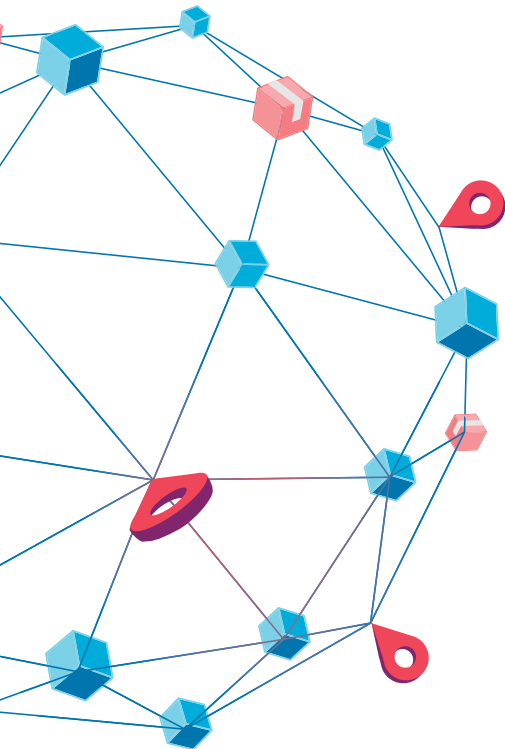
Trust doesn’t just have to be established, either. It also needs to be demonstrable, and this, too, is a challenge. Performing supply chain due diligence can be a time-consuming, paper-based process, with insufficient budget, limited information on product traceability, inconsistent or missing data, and ever greater demands in areas such as modern slavery, working conditions, foreign bribery, conflict finance, and environmental sustainability. For example, it’s not unusual for a shipping container transporting cargo from, say, China to Europe, to need sign-off from dozens of unique organizations, involving hundreds of interactions.

This is why gathering, consolidating, and managing information on the chain of custody or traceability of goods through the supply chain is so crucial.

Consumer needs and their implications

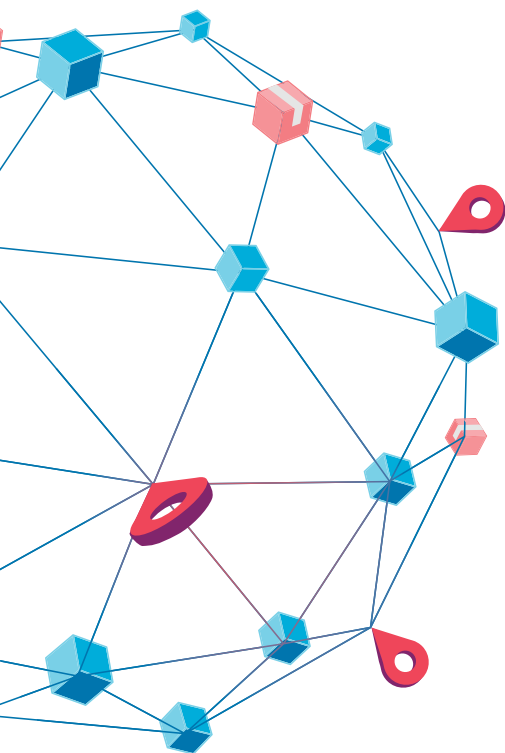
If operational excellence is a regulatory requirement, it’s also being driven by increasingly demanding consumers. People want products to be affordable and immediately available – but there are growing public concerns regarding the origin, quality, and validity of products. Consumers want to know they can trust label certifications and that the environment credential of the product and the companies have substance.

The COVID-19 crisis has reinforced these twin needs. People want to benefit from traceability features and quality, but at the same time, they require them to be very rapidly implemented. For instance, they want facemasks as soon as possible – but they want to know where they’re from, and that they are certified to be fit for purpose.



“Performing supply chain due diligence can be a time-consuming, paper-based process, with insufficient budget, limited information on product traceability, inconsistent or missing data, and ever greater demands in areas such as modern slavery, working conditions, foreign bribery, conflict finance, and environmental sustainability.”

Jean-Baptiste Meriem
Blockchain Lead, Capgemini Invent



Companies therefore have to reinvent themselves and rely on new technologies. These include:

- **Continuous monitoring** – control towers are more important than ever as they allow teams to take strategic, tactical, and real-time operational decisions. They help in improving decision making, shifting supplier allocations, and in ensuring more accurate demand planning
- **Flexibility and agility in production and logistics schedules** – businesses can adjust their production and logistics schedules to prioritize customer/product segments in line with new constraints or with mismatches in demand and supply
- **Full visibility and transparency** – building visibility into the operations and vulnerabilities of suppliers and logistics partners enables organizations to respond quickly to potential supply disruption.

Traceability issues – introducing blockchain

As we've mentioned, one of the main due diligence challenges is limited information. However, this is just one of the problems with traditional traceability – the product trail can be difficult to replicate, and it isn't always easy to gather all the required product information at the same time. What's more, even when all information is available, it isn't always consistent – different parties in the supply chain may use different notations, and regulatory compliance requirements between sectors can also vary, creating different criteria for the presentation of information. Add to this the fact that the information handling processes may themselves be underperforming, and the scope for traceability challenges is plain to see.

The list of participants in a supply chain includes manufacturers and suppliers, transportation companies, warehousing facilities, intermediaries such as dealers and OEMs, and end-customers or consumers. Blockchain technology sets up a common network that is able to connect all these groups to one another. It also enables events to be traced on the blockchain ledger.

In supply chain terms, blockchain creates two kinds of participant:

- **Active** – organizations that need to write and validate transactions (such as suppliers, transporters, OEM, and warehouses)
- **Passive** – external parties, such as those that can have read-only access to the blockchain (including public sector bodies, banks and insurers), and also such as clients.

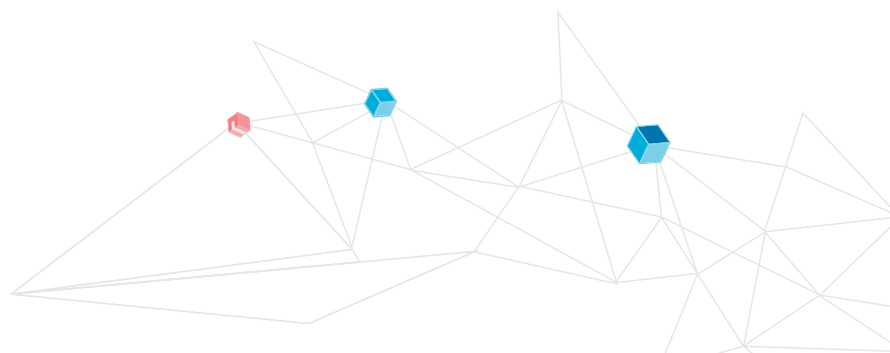
In recent years, the retail, insurance/financial services and pharmaceutical sectors have taken the lead in implementing blockchain traceability initiatives at scale.

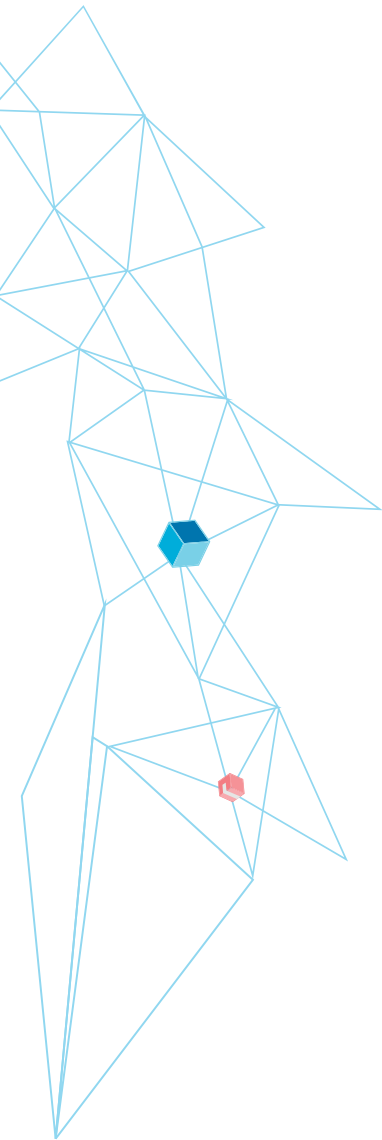
Let's consider two potential approaches to the implementation of blockchain traceability in a supply chain.

Centralized trust

In the first case, customers want an immutable system-of-record or ledger, in which each change can be easily traced and verified cryptographically, and in which no history can be lost or falsified. Such organizations might include healthcare businesses that need to verify and track hospital equipment inventory, HR, and payroll departments tracking changes to an employee's profile, or manufacturers tracking the distribution of a product that has been recalled. Because of the nature of their operations, these organizations are happy to have a centralized ledger.

For instance, let's take a public sector body responsible for motor vehicles. It will have a current record of all the vehicles in its jurisdiction. It will also have the historical data.





For customers such as these, it's possible to build what has been termed a quantum ledger database (QLDB). This has two components:

- The current state and an indexed history of all transactions, including the current value and historical state of the data
- A journal, which has a cryptographically verifiable and sequenced log of each transaction or change in the system. The changes are chained together as blocks.



This means that, when application data comes in, it gets logged to the journal first, and then gets stored in the database, so it can be queried.

Decentralized trust

There's a second set of use cases where you have many complex workflows that span multiple organizations. Often, in these instances, the organizations must collaborate with each other, but none of them can rely on a specific member to manage the shared system of record, either because they don't want them to have a competitive advantage, or because they don't want dependencies over which they lack control. Examples include financial institutions conducting peer-to-peer payments, mortgage lenders processing syndicated loans, retailers streamlining customer rewards, and of course, supply chains, transacting with their suppliers and distributors.

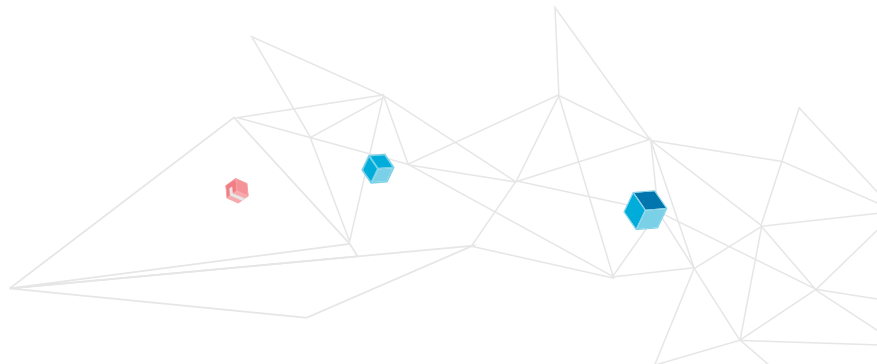
Before blockchain, many industries were obliged to pass paper around, because a more elaborate system would still be hampered by these various forms of reluctance to share or to relinquish control. Now, however, a fully managed service such as Amazon Managed Blockchain makes it easy to create and manage scalable blockchain networks using popular open-source frameworks.

Figure 3: How blockchain can help to address issues with traceability in traditional supply chains

 CHALLENGES	 SOLUTION
Product trail difficult to replicate	Audit trail for all transactions
Difficulty to gather all product information at once	Digital thread
Internal process optimization opportunities	Smart contract and automation digitalized processes near real-time
Regulatory compliance depending on each industry	Immutable ledger with easily verifiable tamper-proof data inherent robustness
Asymmetry of information between actors	Single shared source of truth automated data reconciliation

“A fully managed service such as Amazon Managed Blockchain makes it easy to create and manage scalable blockchain networks using popular open-source frameworks.”

Lana Kalashnyk
 Global Partner Technology Lead
 Blockchain, Amazon Web Services (AWS)



“Track and trace functionality solutions implemented with blockchain enable entire supply chain networks to document updates to a single shared ledger, which provides total data visibility and a single source of truth.”

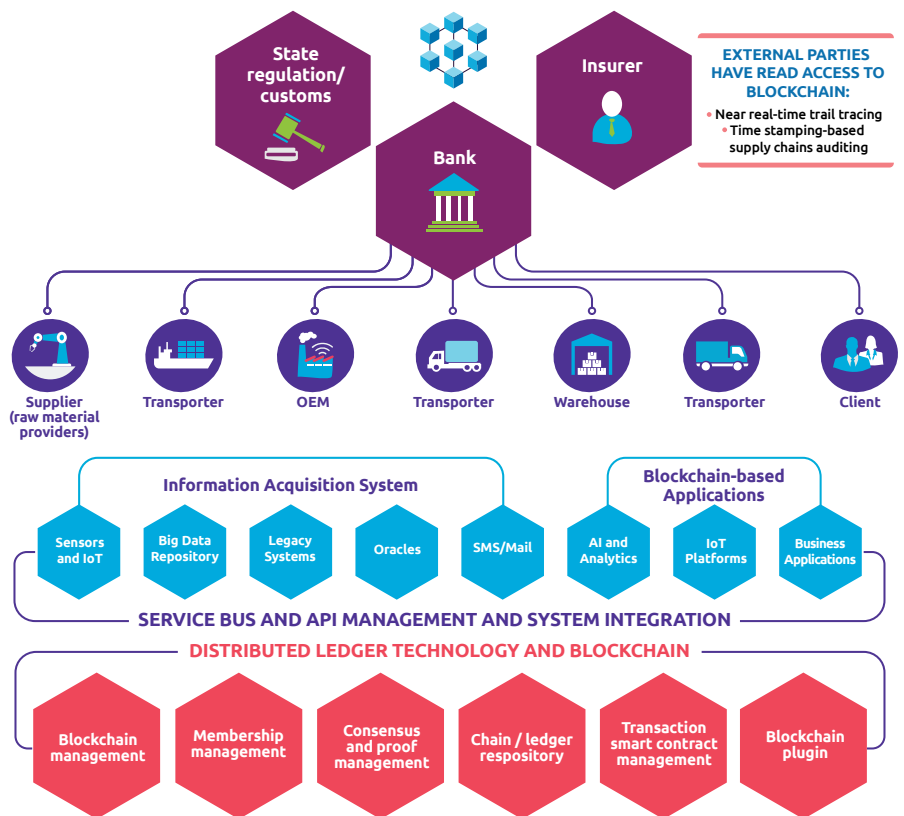
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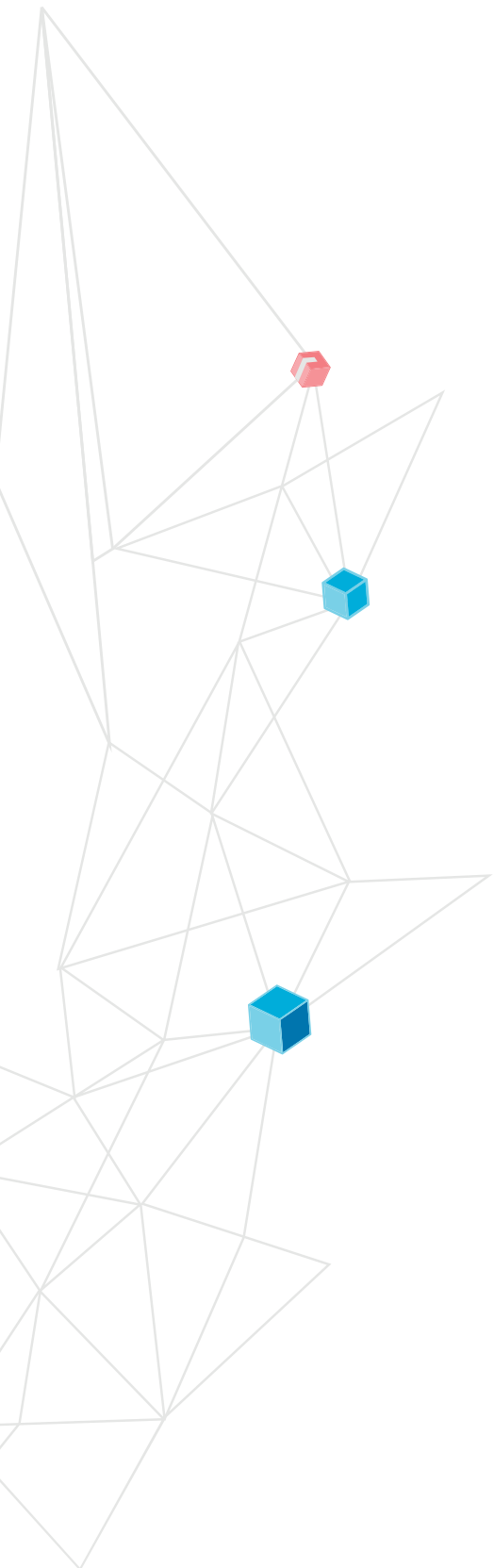
Blockchain – traceability benefits

In short, blockchain can help to address traceability challenges. Track and trace functionality solutions implemented with blockchain enable entire supply chain networks to document updates to a single shared ledger, which provides total data visibility and a single source of truth. We have already seen it's a technology that has been described as “an open, distributed ledger that can record transactions between two parties efficiently, and in a verifiable and permanent way”^[1] – and because of this, it can directly address traceability issues by:

- Providing an audit trail for all transactions, right back to a product's raw materials
- Creating a consistent digital thread
- Enabling automation and smart contracts, so as to streamline processes
- Establishing an immutable ledger, with easily verifiable and tamper-proof data
- Offering a single and shared source of truth.

Figure 4: Blockchain enables every stakeholder to track and trace products in near real-time-traceability benefits





Traceability in action

Let's see how blockchain-enabled traceability can work in practice, across a global enterprise serving a fast-moving consumer market. In this case, we're looking at a major coffee brand.

Consumers take great interest in their coffee. They like to know about attributes associated with its taste, such as its provenance, the type of plantation, how it's processed, how it's graded, how fresh it is, how it's been roasted, and for how long. They also like to know it's been produced ethically, and with due consideration for the environment.

The business naturally wants to satisfy these interests – but it also has information needs of its own. It wants to know about production methods and quality. It wants to know about availability, and not just in the short term. It wants to know about the commercial transactions at different points in the supply chain. And it wants to know about business practices across the board – from the farm through to the packaging function. What's more, the business needs to know all this in real time – coffee is best consumed within just six weeks.

What complicates the picture for consumer and business alike is that there are so many participants. Coffee is sourced from dozens of countries, hundreds of regions, and thousands of farms. There are also thousands of grading facilities, wholesalers, brokers, roasting factories, distributors, packaging suppliers, and retailers.

To ensure that the product and every process is best-in-class, the business needs to track not just the coffee but also the bill of materials that makes the finished product.

In a supply chain as long, as global, and as complex as this, blockchain technology meets the traceability needs of the business, its customers, and of key players in the supply chain:

- **Transparent** – it sets the standard for information sharing between all the partners in the supply chain, with access to and queries of the ledger
- **Immutable** – it puts in place a disciplined data sharing structure
- **Verifiable** – supply chain participants can go back in time to audit each other based on certification.



Sustainability: the role of technology – and of blockchain



Anoop Nannra

Global Blockchain Segment Lead,
Amazon Web Services

The age of carbon tax is upon us. From the implementation of Local Law 97 in New York City to other governments taking a keen interest in this legislation, there is a rising global trend towards greater climate awareness and accountability. Indeed, at Amazon Web Services (AWS), we have committed to sustainability on the cloud, by running our business in the most environmentally friendly way possible, and achieving 100% renewable energy usage for our global infrastructure.

While elected officials in cities around the world are paying closer attention to the methane emissions of their corporate constituents, it is important to note that the technology to measure and report carbon footprint adequately is not yet universally available. This opens opportunities for AWS partner start-ups and enterprises to innovate with solutions to meet this trend. As sustainability innovation today falls into the mature category of ESG (environmental, social, and corporate governance), it is becoming clear that this is more relevant than ever before.

Sustainability – the new governance metric

There is also growing evidence that sustainability will be one of the strategic pillars in corporate governance. We are now seeing companies outline comprehensive mechanisms and controls based on the value attributes of sustainability. This not only governs how companies will operate and how they hire, but how they go to market, how they define channels to market, how and who they partner with, and how they select vendors and suppliers. While we are seeing very early signals of this new sustainability driven corporate governance model, impacts across supply chains are starting to emerge. Could this be the emergence of a new business norm?

It is customary to consider ties between supply chain and carbon offset commitments as an obvious benefactor of a sustainability initiative, but we are also seeing the broader value chain benefit. As newer corporate governance models surface, changes to HR policies, procurement policies, partner strategies, and more, will evolve as well. However, as with most efficient markets, considerable business process automation needs to occur in order for this to happen. More importantly, the efficacy of these processes and the data they consume must be treated as a first-class design consideration.

This is where I believe the application of blockchain technology and its integration with machine learning and analytics can form a powerful combination to automate many of what I believe will become shared business processes. Fundamentally, for an ecosystem to become more holistic in its approach to sustainability goals, data efficacy is critical.

Business continuity and sustainability – interdependent benefits

While much of the attention in the blockchain space is focused on data integrity, process integrity is equally important. The continuous execution of shared business processes, as is exemplified and put to practice through smart contracts in blockchain networks, yields the creation of an operating environment where business functions never stop. Applied to the vast number of sustainability use cases, this new perspective on business continuity results in metrics and actions that not only provide automation of the validation of sustainability goals, but can also automate course corrections and adaptation to dynamic ecosystem conditions. Whether it be applied to renewables, e-waste, food scarcity, or consumer packaged goods, the application of blockchain technology in combination with machine learning and analytics enables enterprises to accelerate not only their own ESG goals, but also the ESG goals of entire ecosystems.



How blockchain can enhance transparency and accountability between participants



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Co-founder, CTO, CSRHub

In this paper we're focusing on the relationship between the buyers, their suppliers, and other participants in the supply chain. As the title of this paper says, we're also looking at how blockchain can enhance transparency and accountability between all these players.





Know your supplier (KYS)

Major organizations these days maintain highly complex webs of suppliers. They may be in different tiers – organized, for example, by geography, or by the nature of the product or service they provide. They will also, almost certainly, be at different levels, too: an engine manufacturer doesn't make its own steel, and a dressmaking supplier probably won't make its own buttons.

All of this makes it hard for enterprises not only to reach and understand all these suppliers, in their many tiers and at their many levels, but to maintain up-to-date information about them. Creating and maintaining a supply chain map will improve control, and will help organizations to see potential problems early, react to them, assess their risk, and take decisions promptly. The COVID-19 outbreak has heightened the need. As the [Harvard Business Review said recently](#), "A small minority of companies that invested in mapping their supply networks before the pandemic emerged better prepared. They have better visibility into the structure of their supply chains."

Just as in consumer markets, the current mantra is "know your customer," so in the supply chain, it's more strategically important than ever for organizations to know their suppliers. This, however, can represent a significant data management challenge, and in two ways.

The first is supplier relationship management. Businesses need to have real-time processes in place for onboarding, for requesting updates, and for managing lifecycles and supplier performance.

The second is supplier risk management. Here, businesses need to establish alerts for key performance indicators (KPIs), and to monitor operational risks in areas such as disruption, quality, and creditworthiness. Possibly most critically of all, they need to be mindful of reputational risk, commonly termed ESG (environmental, social, and governance). Managing ESG is growing in strategic significance, sometimes to existential levels: for instance, revelations of slave labor or of habitat destruction in the supply chain could lead to the unmaking of a previously respected brand.

Addressing these two areas is a substantial data management challenge, because all this information must not only be gathered into comprehensive profiles of individual suppliers, but maintained and monitored in real time.

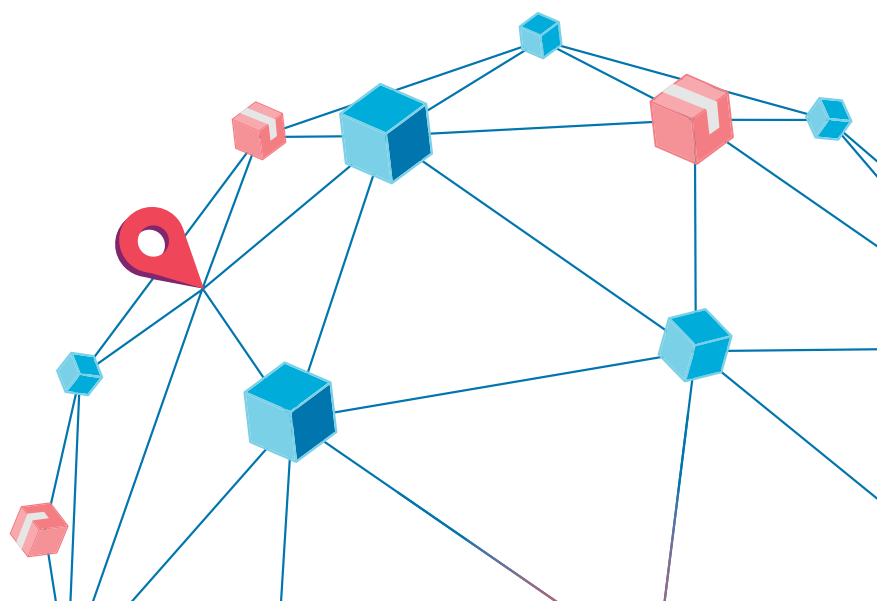
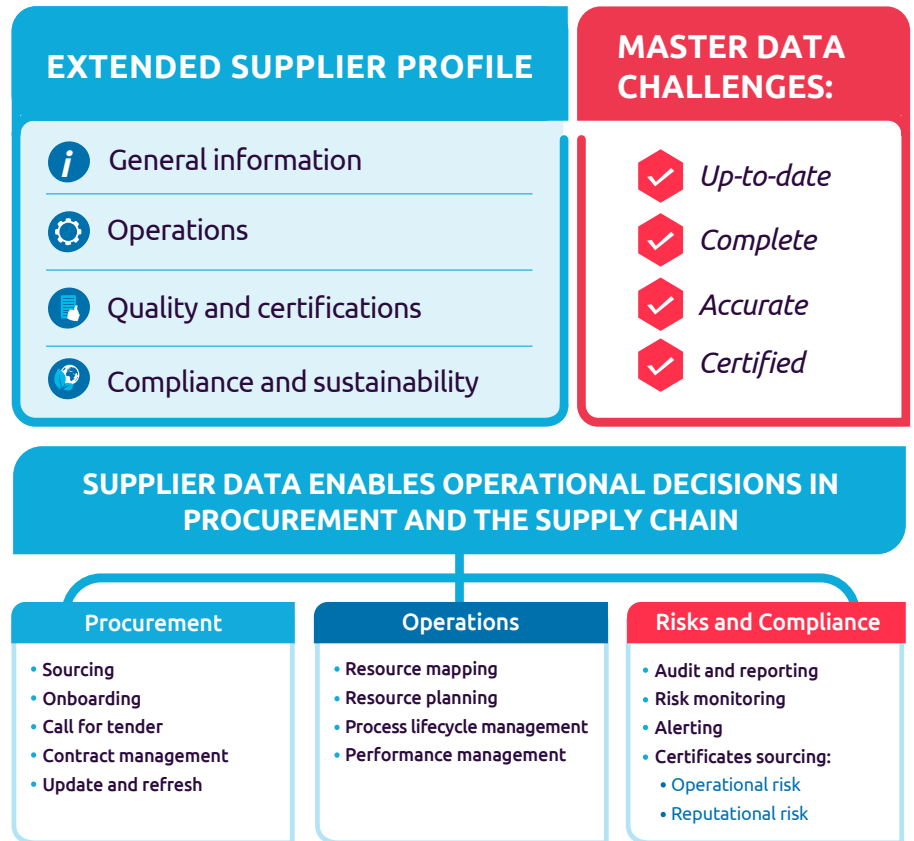




Figure 5: KYS is all about building and maintaining extended supplier profiles for the benefit of procurement, operations, and risk functions



KYS – what’s needed

In the first case, customers want an immutable system-of-record or ledger, in which each change can be easily traced and verified cryptographically, and in which no history can be lost or falsified. Such organizations might include healthcare businesses that need to verify and track hospital equipment inventory, HR, and payroll departments tracking changes to an employee’s profile, or manufacturers tracking the distribution of a product that has been recalled. Because of the nature of their operations, these organizations are happy to have a centralized ledger. For instance, let’s take a public sector body responsible for motor vehicles. It will have a current record of all the vehicles in its jurisdiction. It will also have the historical data.

To manage supplier relationships, there are several prerequisites for data collection:

- Privacy needs to be designed in, so as to earn suppliers’ trust
- Outreach needs to be easy. Why make the task laborious?
- Tools should be user-friendly
- Processes should be designed so as to avoid the duplication of tasks. Suppliers have to fill out plenty of forms as it is
- Updates to information should be pushed through from suppliers automatically.

But that’s not all. Everything on the list above needs to be replicable at scale. Major enterprises can have as many as 10,000 or 15,000 suppliers. In order to achieve widespread adoption, data should be pre-filled as much as possible from external sources. Anything that makes life easy increases the chances of it happening.

“Customers want an immutable system-of-record or ledger, in which each change can be easily traced and verified cryptographically, and in which no history can be lost or falsified.”

Damien de Chillaz
Head of Blockchain & B2B Platforms,
Capgemini’s Business Services



Also, there should be incentives for suppliers to collaborate. For instance, their profile with a buyer could be presented to them as a “passport.” This means not only that it can be easily used elsewhere, without starting again from the beginning, but also that it acts as a form of endorsement, building the supplier’s credibility, and possibly facilitating access to financing.

With all these supplier relationship management requirements satisfied, organizations will then be able to address their supplier risk management needs, putting real-time risk monitoring measures in place, including alerts and data visualization tools, so they can maintain insight and control.

KYS – what blockchain provides

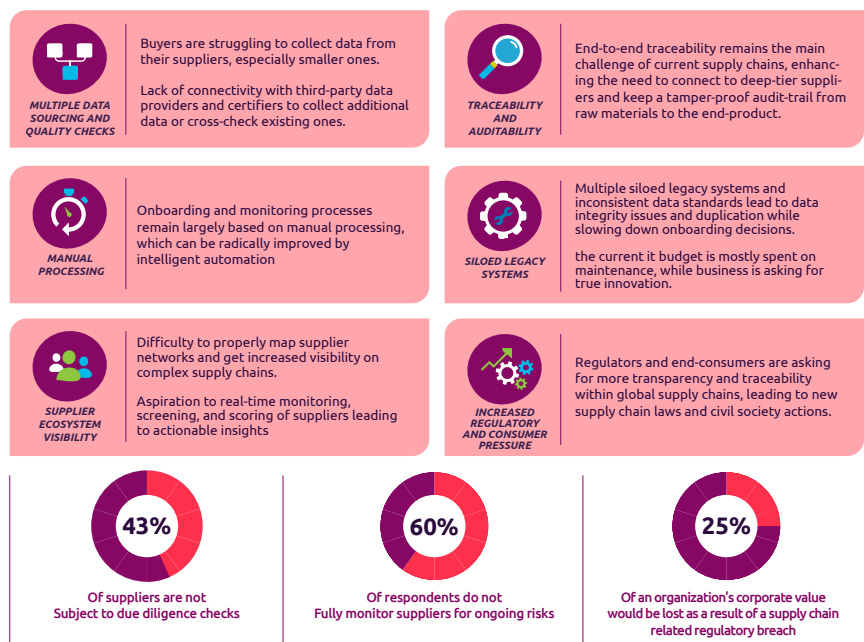
As “an open, distributed ledger that can record transactions between two parties efficiently, and in a verifiable and permanent way.” [1] It addresses each of the main “know your supplier” issues fairly comprehensively:

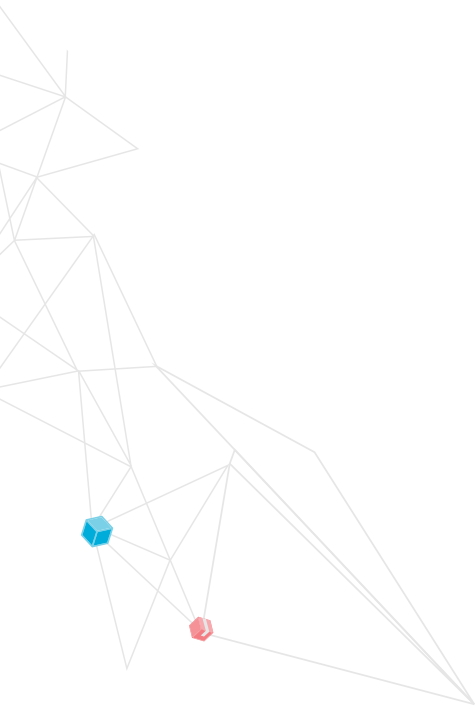
- **Privacy concerns** – blockchain’s cryptography provides peace of mind, ownership and control
- **Manual processing** – automation enables smart contracts and cuts down on paperwork
- **Lack of trust** – blockchain provides full traceability, enabling an end-to-end audit trail
- **Accountability** – blockchain establishes a trusted ID, so everyone can be certain of who is sending information, or requests for information. This facilitates the secure exchange of certificates and verified credentials
- **Lack of visibility** – by providing an ecosystem of network connectivity, blockchain facilitates network mapping, and simplifies direct outreach.

Figure 6: Knowing your suppliers is more strategic than ever and is a master data management and risk assessment challenge

“Blockchain establishes a trusted ID, so everyone can be certain of who is sending information, or requests for information. This facilitates the secure exchange of certificates and verified credentials.”

Edouard Morio de l’Isle
Blockchain & B2B Platforms
Business Development, Capgemini’s
Business Services





A trusted data exchange for KYS

Capgemini has developed a blockchain-based asset, called [Trusted Data Exchange](#), designed to bring those benefits in the context of KYS. Trusted Data Exchange establishes private, peer-to-peer communications between buyers and suppliers, each of whom has its own secure and structured vault of data and documents. The identity of each party is firmly established, and the end-to-end, tamper-proof audit trail keeps track of any exchange of information.

In a supply chain environment such as this, processes are streamlined, cost efficiencies are possible, and decisions are actionable faster. All parties fully own their own data, and sharing is based on consent. It can be used to manage workflow traceability (with delivery notes and purchase orders, for example); to establish compliance (of participating businesses, and of their different locations and assets); and to support procurement (for instance, with supply chain financing).

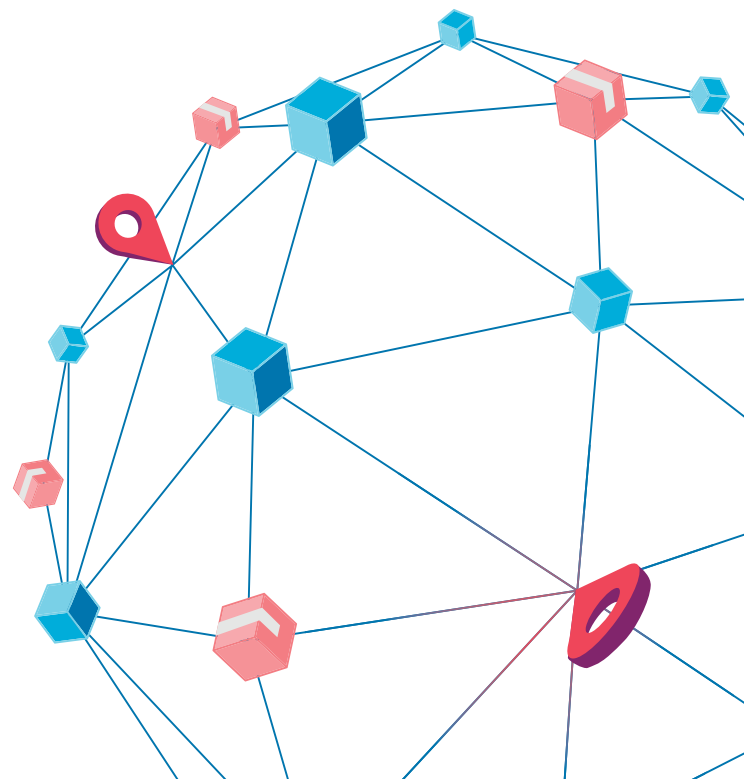
An environment such as this makes supplier onboarding much more straightforward for all parties. Third-party information providers such as general business data sources and specialist certifiers can pre-fill some of the general information and ESG fields on a questionnaire, perhaps leaving for the new supplier's completion only those fields it may not have been asked to fill by anyone else before. Similarly, certification can be much simpler: buyers can request certifications from their lower-level suppliers either directly or via their Level 1 suppliers in a completely secure and traceable communications channel. Here, too, third-party data specialists can provide statutory compliance and ESG information, reducing the inherent workload for all parties.

What emerges from all this is the goal of the supply chain map, with which this article began. Buyers gain control and oversight of their entire supply chain, across both tiers and levels, enabling them to manage operations and monitor risk. Suppliers gain by knowing they are ratified and trusted by their buyers, by knowing that they can return that trust, and by knowing, too, that remain in control of their own data.

These developments could not have come at a better time. For one thing, as we have noted, the pandemic has created new pressures on the supply chain; and for another, in recent years, major enterprises have grown more aware than ever of public expectations, and have been making significant commitments to sustainable development. It is therefore especially incumbent on supply chain management functions to demonstrate accountability against KPIs such as ESG metrics – and this is clearly something that blockchain can help them to deliver.

“Trusted Data Exchange establishes private, peer-to-peer communications between buyers and suppliers, each of whom has its own secure and structured vault of data and documents. The identity of each party is firmly established, and the end-to-end, tamper-proof audit trail keeps track of any exchange of information.”

Damien de Chillaz
Head of Blockchain & B2B
Platforms, Capgemini's
Business Services



“ Analysis conducted by CSRHub has shown that clothing companies are doing a good job of reporting several metrics identified by the Sustainability Accounting Standards Board. However, supply chain metrics are inconsistent and difficult to verify.”

Bahar Gidwani
Co-founder, CTO, CSRHub

“ Blockchain would establish a framework that is consistent, comprehensive, and private, enabling individual buyers and the industry as a whole to manage supplier relationships, manage risk, and demonstrate to the outside world their determination to act responsibly.”

Bahar Gidwani
Co-founder, CTO, CSRHub

Industry focus – apparel

The clothing industry provides an interesting example of how increased supply chain transparency could benefit society.

The Sustainability Accounting Standards Board (SASB) is a US organization that assesses the applicability and reporting of metrics. SASB has indicated that certain aspects of sustainability are material to investors for apparel, accessories, and footwear companies. One of these material aspects is how well these companies monitor their supply chain.

Analysis conducted by CSRHub has shown that clothing companies are doing a good job of reporting several of the metrics SASB identified. However, based on data CSRHub aggregated from hundreds of private sector and public data sources, clothing company supply chain metrics are inconsistent and difficult to verify.

Apparel industry companies and their stakeholders are interested in improving this situation. While apparel companies hope to highlight areas of risk and improve quality and delivery performance, other stakeholders seek to eliminate child slavery, improve working conditions, and encourage participation in apparel supply chains by minority and women-owned businesses.

Recognizing the need to change, a consortium of apparel companies, not-for-profit organizations, government bodies and industry groups have established the Open Apparel Registry (OAR). The OAR’s map already comprises over a hundred buyers, and thousands of supply facilities. Its usefulness has already been demonstrated, even at this early stage, by the ability to log personal protective equipment (PPE) manufacturer data.

However, this effort does not yet incorporate or rely upon blockchain technology. One reason is that OAR data cannot track what buyers bought or what suppliers provided. It is not tied to specific standards. Buyers and suppliers are reluctant to share information that could be of advantage to their competitors.

Blockchain technology would directly address these issues, by establishing a framework that is consistent, comprehensive, and private, enabling individual buyers and the industry as a whole to manage supplier relationships, to manage risk – and to demonstrate to the outside world their determination to act responsibly.





How blockchain can automate **procure-to-pay** in the supply chain



Manuel Sevilla
Chief Digital Officer,
Capgemini's Business Services

In this paper we're focusing on procure-to-pay (P2P) processes, which can cause significant problems for everyone in the supply chain.

Frequently considered to be slow, inefficient, and prone to error, the P2P process is also exposed to reconciliation problems and the risks of fraud. In this paper, we will examine how blockchain can streamline and automate P2P processes by reconciling purchase orders, invoices and receipt of goods.





Purchaser challenges...

First of all, let's consider potential issues in conventional approaches to P2P from the perspective of purchasers.

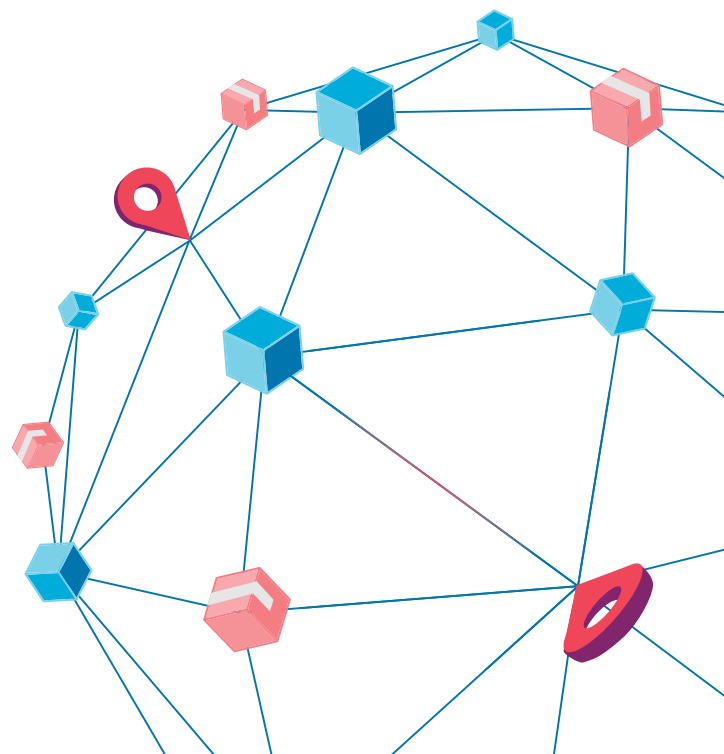
A need is identified. The purchaser seeks a supplier to fill it, and asks for a formal quote against which to raise a purchase order. So far, so straightforward. But it may be the wrong supplier – for instance, a company that isn't approved to provide those goods or services. The quote details may be wrong – or they may be right, but they have been transposed incorrectly. This may result in errors in the address, in the price quoted, or in the quantities involved. It's also possible the purchase order may have been raised, but not sent. It may have been raised twice, or sent twice, or both.

Next, an invoice is received. It may not quote the relevant PO number. In fact, there may not even be a purchase order at all, either because it has been lost in the process, because the supplier didn't know the process, or because it is fraudulent. Alternatively, it may contain the wrong information, making it hard to reconcile with the corresponding purchase order.

A goods receipt is created, proving delivery to the purchaser. If it's for raw materials, it might go to manufacturing on the factory floor. If it's a finished product, it might be destined for a retail outlet for resale. But perhaps the goods receipt was handed over in a loading bay, and now it's been lost. Or it doesn't tally either with the purchase order or the invoice – the wrong product, perhaps, or the wrong quantity, or the wrong delivery address.

The matching process ought to bring everything together, ensuring that the purchase order, the goods receipt, and the invoice all correspond, not just in value, but in other details. But this may not be the case, and besides, the price quoted, accepted, and charged may not reflect a long-standing discount agreed between the purchaser and the supplier. Other contract details may have changed – and a key contact person from one side of the transaction may have moved on.

Finally, there's the payment stage. All the paperwork thus far has checked out, but now it's discovered the supplier's IBAN (bank account details) are wrong. Or the wrong value has been transcribed into the payments system. Or the bank has rejected the payment for some reason. Or it transpires that, rightly or wrongly, the supplier is currently on a blacklist, and even though goods have been received, payment can't be made.



“Frequently considered to be slow, inefficient, and prone to error, the P2P process is also exposed to reconciliation problems and the risks of fraud. Blockchain can streamline and automate P2P processes by reconciling purchase orders, invoices and receipt of goods.”

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Chief Digital Officer, Capgemini's Business Services

... supplier challenges...

All of these issues can lead to potential interruptions to the purchaser's receipt of goods or services. For suppliers, however, the problem might be the far more fundamental one of disruption of income.

Regardless of where responsibilities for problems may lie – with the purchaser, or elsewhere – these various issues are pretty much replicated for the supplier. From this side, they are no longer P2P processes, but order-to-cash (O2C) matters. Once again, there may be errors with the purchase order that prevent the supplier from initiating the delivery of goods or services. The supplier's own accounts team might make a mistake when raising the invoice, issuing it in the wrong currency, for instance. There could be problems with what was delivered and to where, and also, as before, with the corresponding goods receipt.

The payment recovery process could be impeded by document mismatches, or by those discount discrepancies we mentioned just now. In fact, this could be a bigger issue than it sounds: the bigger the supplier and the purchaser involved, the more discount options there are likely to be.

Finally, once more, there's the payment stage. In addition to the potential problems of error or of transaction blocks by the bank, there's also the possibility of reconciliation issues. In short, sometimes it's not obvious who paid. The supplier then spends time chasing a late payment that the purchaser can't identify – and it's all because funds were issued, for instance, in the name of the holding company instead of the operating company.

... and other challenges

So, there are potential problems for purchaser and supplier alike. But all of this is for when only two parties are involved. We've already seen that there can be delays and problems at the bank – but there may be other organizations in the supply chain, including resellers and logistics companies. Each one of them constitutes another stage, and therefore another layer of possible issues.

What's more, thus far, we've been talking about each party as though it were a single entity. It isn't, of course. Each organization is an ecosystem of finance teams, procurement, legal, sales, and more. For things to work properly, they all need to be on the same page.

How blockchain can help

As we've observed several times in papers in this series, blockchain technology is “an [open, distributed ledger](#) that can record transactions between two parties efficiently, and in a verifiable and permanent way.” It's clear, ^[1] it's dependable, it's secure, and it's auditable. What's more, it's designed to be automatable, and because it's API-native, it can be orchestrated by any other app layered on top of it. All of which means it can address the many potential challenges we've just considered in the P2P process.

Here's a summary of the problems, and of the solutions that blockchain can offer:

- **Paper-led processes** – digitization and secured data sharing establish a single source of truth, right along the process chain. There's no possibility of transcription errors
- **Inefficient, ERP-based, and manual processes** – API-native blockchain enables straight-through processing and automation
- **Exceptions, causing friction** – digitizing conditions creates comprehensive rules on which smart contracts can be based that can cover all cases
- **Lack of visibility** – a shared ledger means every process step is visible to every party involved. The ownership and status of each transaction is clear to all
- **Fraud and identity threats** – blockchain establishes trusted identities and credentials, providing a basis for the secure exchange of information
- **Compliance risks** – blockchain provides an automated, end-to-end audit trail. This can help organizations to demonstrate not just that transactions were completed properly, but that they were completed on time. In some countries, companies need to be able to prove they paid their suppliers within statutory timeframes.



“Blockchain doesn't exist to replace anything in P2P, but to enhance it. It automates, simplifies, and secures processes, reduces overheads, and makes everything clear, verifiable, and auditable.”

Manuel Sevilla

Chief Digital Officer, Capgemini's Business Services

Clarity and simplicity

A case in point is a trusted data exchange solution we developed to help a client organization build a structured approach to intercompany transactions. The solution makes use of UiPath, R3 Corda, and other third-party technologies, and ensures that each party in the supply chain has access to data in a ledger that is specific to that party.

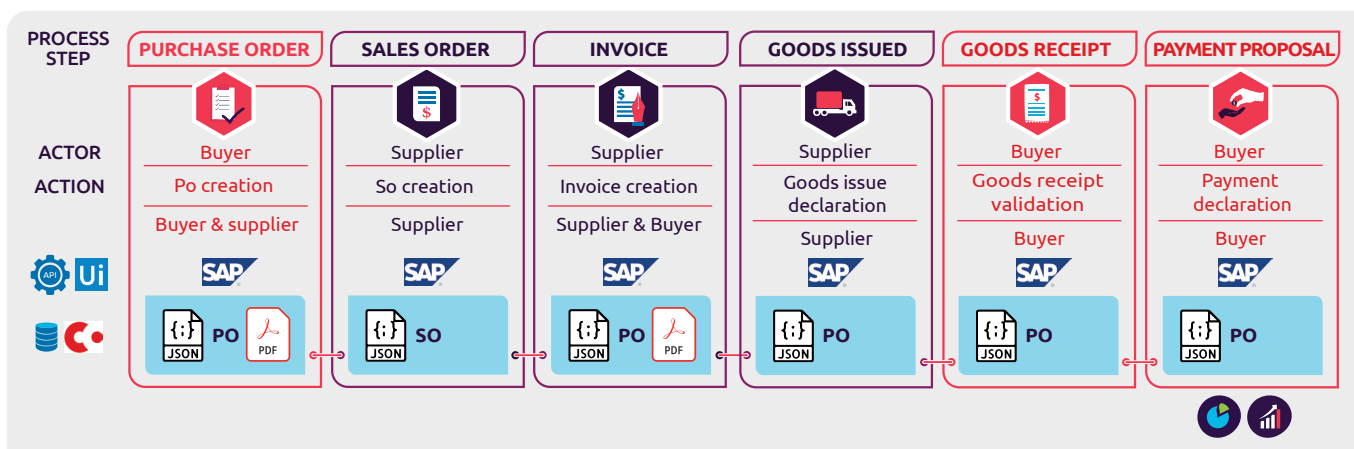
Data is shared by consent – each organization can request and receive information, and can attach relevant documents such as purchase orders and invoices. What's more, everything is time-stamped, so relevant parties can see not just that everything verifiably happened, but when it happened (see Figure 7).

In this case, the organization was able to digitize and automate 60% of its inter-company P2P processes, and to decommission a 1,200-seat software licence that had been needed in order to make physical cut-and-paste transfers of data from one ERP system to another. The blockchain model is now being rolled out to accommodate even more exceptions.

The benefits are clear – not just in this individual case, but in general. However, this doesn't mean that blockchain is mandatory. For instance, small suppliers, who may not have sizeable accounts systems or teams, can continue to work for large, blockchain-using customers, uploading and downloading purchase orders and invoices in the usual way.

Blockchain doesn't exist to replace anything in P2P, but to enhance it. As we've seen here, it automates, simplifies, and secures processes, reduces overheads, and makes everything clear, verifiable, and auditable.

Figure 7: A P2P intercompany case study – simplified flow





How blockchain can secure IoT devices in the supply chain



Thierry Batut
Head of IoT Business Line,
Capgemini DEMS



Nafissatou Diarra
IoT & Blockchain,
Capgemini DEMS

In this paper, we're going to consider the role of Internet of Things (IoT) devices in the supply chain, and how blockchain can ensure their security.





The IoT value chain

In any business application, and in supply chain management in particular, the key IoT elements are as follows:

- **The IoT sensors themselves** – the remote devices attached to assets in the field that are programmed to harness data
- **Connectivity** – the medium, such as WiFi or Bluetooth, which is used to communicate this data to...
- **... the IoT edge** – these outlying hubs aggregate local data and conduct primary analytics
- **Network infrastructure** – this brings together data gathered from the edge, and provides it to...
- **... the IoT data management platform** – the central hub, which monitors sensor activity and health, and processes the data being gathered
- **Analytics** – the suite of tools that interprets all the data and extracts its value.

It's clear that, right across this value chain, security is a prerequisite. This security needs to be guaranteed at several levels: at the device level (for instance, to manage the device's identity and lifecycle); at the data level (to guarantee its integrity and origin, and manage access to it); and at the level of information exchange (such as authentication between devices and gateways). However, at the same time, the value chain needs to be agnostic, so as to accommodate a variety of third-party devices.

How can blockchain help?

In previous papers in this series, we've seen how blockchain technology can address many of the issues that regularly arise in supply chain management, and IoT-based systems are another case in point.

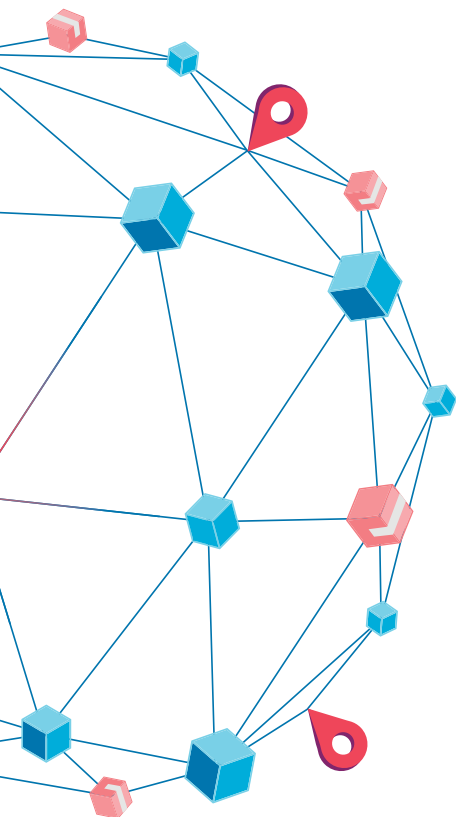
In the boxed text in this article (see '[IoT in action: tracking valuable assets](#)'), you'll see a range of issues that IoT devices can address, and security is implicit in all of them. Blockchain technology, which, as we have noted, has been defined as "[an open, distributed ledger](#) that can record transactions between two parties efficiently, and in a verifiable and permanent way," could potentially provide a solution to these issues, and more. For instance, IoT architectures are often centralized, whereas blockchain can sometimes enable a move to distributed and decentralized models, thereby improving fault tolerance.

Fraud is reduced because of real-time incident alerts and better tracking. Product traceability is significantly enhanced, because of the verifiable levels of identification inherent in the system. A shared source of trust is established between stakeholders. The time and cost involved in monitoring shipments is reduced. Also, overall security is improved, because individual IoT devices are incorporated in the blockchain, enabling all goods to be authenticated before they have even left the manufacturing site and entered the supply chain.



“**Centralized IoT solutions don't just compromise fault tolerance. They also contribute to a higher cost of use. What's more, many of those solutions are optimized for use only with designated device types.**”

Thierry Batut
Head of IoT Business Line,
Capgemini DEMS



Blockchain security at device level

Centralized IoT solutions don't just compromise fault tolerance, as mentioned above. They also contribute to a higher cost of use. What's more, many of those solutions are optimized for use only with designated device types.

A further challenge is that many such solutions are unable to distinguish between different use case cases, and the different security issues they present. For instance, a home video surveillance system, involving a few domestic devices, will not have the same security needs as a robotic production line, where the impersonation of one of the main robots could turn out to be devastating for the concerned company.

This is why it is important to have a blockchain-based solution that can not only adapt to the capabilities of devices, but that can also offer various levels of security or of identification, according to the circumstances of the use case, and that can, in addition, incorporate an authentication method and effective access management.

Blockchain can help significantly in achieving the goal of securing IoT devices. In addition to the immutable nature of its ledger, the fact it is able to use a permissioned option such as Hyperledger Fabric, R3 Corda or Quorum makes it possible to involve all the players of the device ecosystem, including the manufacturer and the customer, in the process of validating transactions, and therefore verifying and validating the identities of devices, and enhancing trust between all supply chain participants.

The transactions history can be tracked and audited. In addition, smart contracts can be used as brokers for authentication between devices and their associated gateways, and can match roles and authorizations.

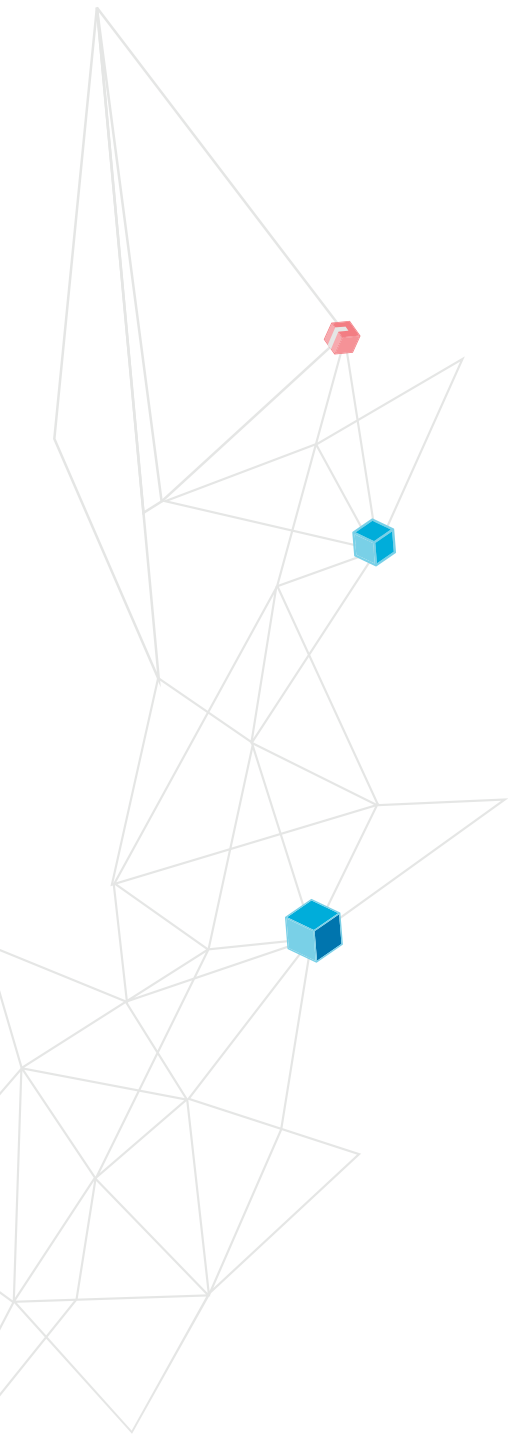
Tackling the issue – a Capgemini project

An approach to IoT management has been developed by Capgemini. It incorporates two protocols that use blockchain technology for support.

The first is the device enrolment and identification protocol, which addresses the secret data pre-injected into the device by its manufacturer. The administrator enters device information (including data related to the device lifecycle and deployment context) on a UI platform. All this, together with the encrypted pre-loaded data, is then hashed and stored on the ledger as the device Identity, after consensus by validating peers. This process is termed an identification smart contract, which queries the ledger to verify the previous existence of an identity, and writes it on the ledger as necessary.

The second protocol enables a device to be authenticated to its associated gateway. This assumes that the device already had an identity stored at the ledger level. Again, the process is based on an authentication smart contract. It works like this. At first, the device sends its public information to the gateway. The gateway then queries the blockchain to retrieve the appropriate data on device (namely the encrypted pre-loaded data, via the authentication smart contract). After that, the gateway generates a challenge and sends it to the device. Finally, an OTP-like authentication protocol is activated between the device and the gateway to authenticate the device.

This project is still at a development stage. It aims to provide a response to scalability and also to decentralized identification issues for IoT, taking into account the characteristics and ecosystems of devices. It will also address other issues, such as managing the possible mobility of devices, or the flexibility of the solution to adapt to different use case models according to their security needs.



IoT in action – tracking valuable assets

High-value, sensitive equipment

Susceptible to excessive tilt or shock

- **Problem** – standard indicators only reveal something happened after the event – and not when or where
- **Solution** – smart IoT approach alerts a central dashboard to time and place of any incident, facilitating investigation and measures to prevent repeat occurrences.

Goods at risk of theft

Consumer electronics, branded pharmaceuticals, and more

- **Problem** – package-level tracking can be expensive, and analog devices don't properly address theft issues
- **Solution** – GPS-enabled tracking monitors the entire shipment for the entire journey, and in real-time, reporting if a single item is separated from the others.

Perishables

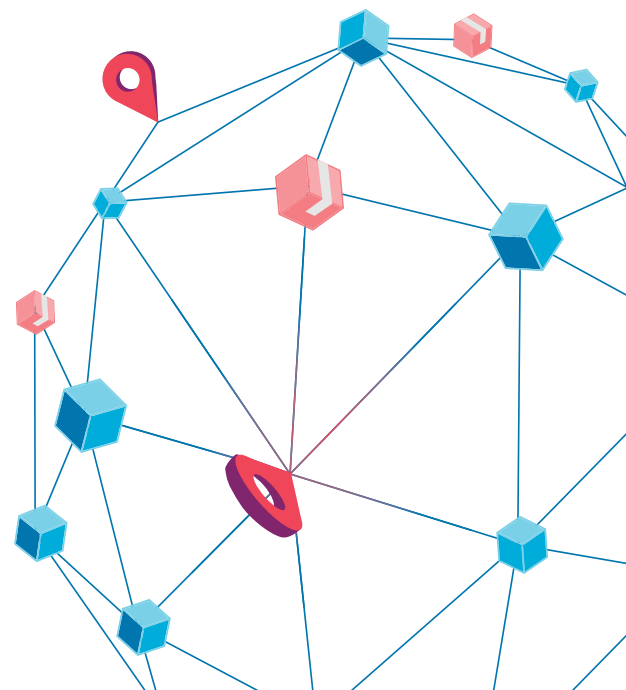
Need to stay within set temperature boundaries to prevent spoilage and meet compliance requirements

- **Problem** – analog devices only provide after-the-fact information, and are cost-prohibitive for package-level tracking
- **Solution** – cost-effective IoT sensors monitor interior and exterior temperatures in near-real time.

“An approach to IoT management has been developed by Capgemini. It incorporates two protocols that use blockchain technology for support.”

Nafissatou Diarra

IoT & Blockchain, Capgemini DEMS





How blockchain can enable carbon tracking within the supply chain



Clémence Lambert
Managing Consultant, Capgemini Invent



Edouard Morio de L'isle
Blockchain and B2B Platforms Business Development,
Capgemini's Business Services

In this final paper, we're going to consider a much broader perspective. We're going to look at the effects of climate change on the supply chain, at the implications it has for data collection and for regulatory compliance, and also at the role blockchain can play in meeting carbon tracking needs.





The race to Net Zero

Every year, the combustion of fossil fuels is adding carbon to the atmosphere, which is increasing global temperatures. The overall “net zero emission” carbon target of 2050, as set out in the Paris Agreement of 2015, is being demanded by the climate movement. It was corroborated by a report from the Intergovernmental Panel on Climate Change (IPCC) in 2018, which affirmed that net emissions must be reduced to zero by 2050 in order to stabilize global temperatures and meet a global warming target of no more than 1.5°C. To meet these internationally recognized targets, carbon levels will need to be [reduced by 45% from 2010 levels by 2030](#), and reaching 0% by 2050 to keep temperature rises below 1.5 °C. This means unprecedented collaboration between countries and organizations from different backgrounds (public, private, and scientific) to align on targets, roadmaps and methodologies. It also means commitment:

- **At national level** – this objective has been ratified by Switzerland, the EU and many other countries, and, if anything, the COVID-19 pandemic of 2020 has intensified international pressure to act. Indeed, according to a recent report, 145% of companies were committed to becoming carbon neutral in 2020, against 20% in 2019.
- **At personal level**– carbon reduction is a target in which everyone will have a role to play, at home, while traveling, and even when working.
- **At private level** – [Microsoft, for instance, will be carbon negative by 2030](#), and will remove its historical carbon emissions by 2050. Capgemini is also taking its part in this global effort, by recently [committing to carbon neutrality by 2025](#), and by also committing to net zero carbon emission by 2030.

¹ *Ecoact 2020 Rapport sur la performance en matière de reporting climat des entreprises du CAC 40*

Guidelines and targets

While everyone races to zero emissions, organizations need to keep track of emerging guidelines from a number of bodies. Some of these guidelines are global or multinational, such as the Greenhouse Gas (GHG) Protocol, which establishes comprehensive standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains, and mitigation actions.

Other guidelines are being set at national level. For example, the Bilan Carbone, which is aligned with GHG protocol guidelines, provides a method of accounting for GHG emissions, and was developed by the French Agency for Environment and Energy Management.

Others again are at sector level – both vertical and horizontal. For instance, and as we’ve noted [in an earlier article in this series](#), a consortium of apparel companies, not-for-profit organizations, government bodies and industry groups has established the Open Apparel Registry (OAR), with the aim of enabling the fashion industry to map buyers and supply facilities, and to monitor them in (environmental, social, and governance terms (ESG).



“One of the most important elements of carbon tracking is transparency: organizations need to be able to demonstrate their progress to a list of stakeholders that includes customers, employees, partners, and investors, some of whom are now founded on ESG principles.”

Clémence Lambert
 Managing Consultant,
 Capgemini Invent

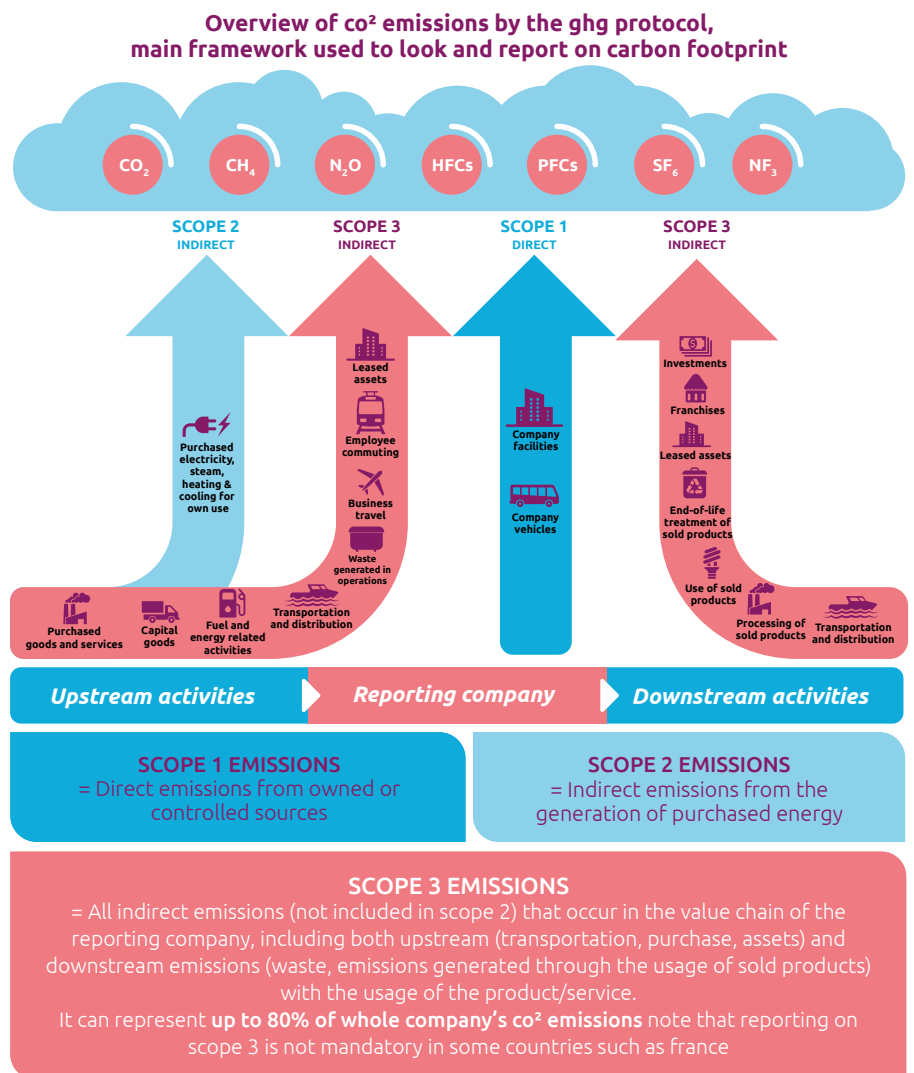
Scoping and measuring

In the supply chain, the operational scope of carbon tracking involves defining the sources of emissions that will be taken into account. The main international standards and methods, and the GHG Protocol, which is the most widely used international accounting tool, together define three categories of emissions:

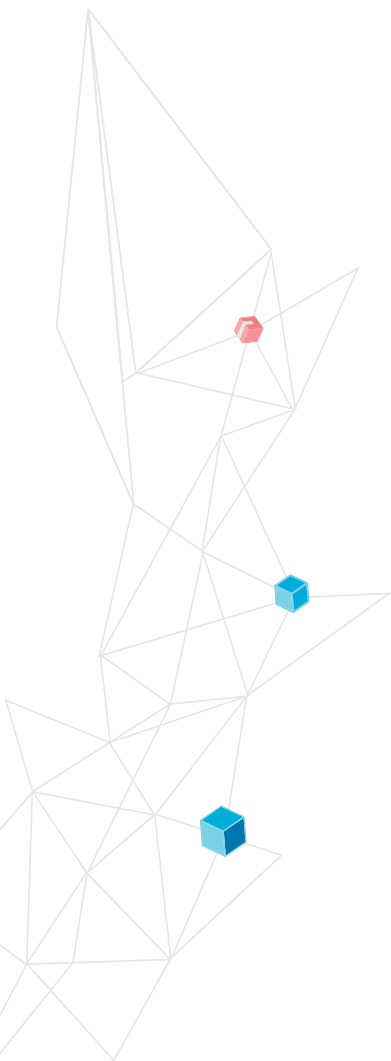
- **Scope 1** = Direct GHG emissions from owned or controlled sources, such as general fuel combustion, company vehicles, and fugitive emissions
- **Scope 2** = Indirect GHG emissions from the generation of purchased energy, such as purchased electricity, steam, heating, and cooling
- **Scope 3** = Other indirect GHG emissions, not included in Scope 2, that occur in the value chain of the reporting company, including both upstream (transportation, purchase, assets) and downstream (waste, emissions generated through the usage of sold products) with the usage of the product/service. Reporting for Scope 3 is not mandatory, but it is nonetheless a crucial category, because it can represent up to 80% of a company's entire carbon emissions.

Needless to say, an organization can only move to Net Zero when it can quantify its current carbon footprint. For large enterprises in particular, this is not straightforward, as they need to prepare, collect, clean, and convert all data across business lines.

Figure 8: The three scopes of emissions



Note that some companies talk about commitment that go beyond scope 1,2 or 3, talking about “avoided emissions” or “sequestered emissions” for others.



“The logic in how blockchain principles apply to carbon tracking is clear. To reduce the carbon footprint of supply chains, companies must be able to collect and track reliable and trusted data accurately and repeatedly.”

Edouard Morio de L'isle
*Blockchain and B2B Platforms
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The data squeeze

One of the most important elements of carbon tracking is transparency: organizations need to be able to demonstrate their progress to a list of stakeholders that includes customers, employees, partners, and investors, some of whom are now founded on ESG principles. They have to show how they are doing against their own commitments, and against their peers. They have to show they are improving their performance. They also need to monitor their activities, so they can learn lessons, enabling them to improve performance further still.

It isn't straightforward. With sustainability issues, there are numerous and evolving rules surrounding the scope and the frameworks of reporting and disclosure that are conducted on a voluntary or regulatory basis. Also, there are specific rules to compute and translate activities into sustainability information, such as carbon calculation models and carbon factors, often varying by country – and these, too, are evolving.

Transparency also requires accuracy, completeness, and clarity. Large volumes of data need to be collected across the organization, and then cleaned. Where data doesn't exist – the carbon emissions from a supplier's services, for example – it will need to be gathered ad hoc, or estimated.

Under pressure

It's a sad fact that most organizations are ill-equipped to address such a large and multi-layered task, which often forms part of the workload of Corporate Responsibility and Sustainability (CR&S) teams. These teams are often distributed within companies, some in a central location and others at country level. Reporting is often managed centrally by just two to five people on an Excel sheet, and represents a considerable amount of data collection and data cleaning in order to be comprehensive. In fact, sustainability teams typically spend 80% of their time gathering, structuring, and analyzing data, but only 20% working on strategy.

The four major challenges that sustainability teams are facing can be summarized as the ability to:

- Collect more and more granular data from different sources, clean it, and transform it into real insights, at scale, and on a regular basis
- Report sustainability data with confidence, and focus on the reports that matter
- Cascade the right level of information to decision-makers, and incentivize them to improve sustainability performance across the organization
- Collect and guarantee the quality of the data in new areas of the value chain, such as middle-sized suppliers, who may not report their own data.

The good news is that new solutions are now taking advantage of cloud computing, artificial intelligence (AI), and analytics to offer a more convenient way of monitoring carbon, for greater transparency and performance.

However, they are still not answering the challenge of collecting carbon data all along the supply chain. This is a significant problem. For a start, measuring all supply-chain emissions requires a high level of integration and coordination between multiple supply chain networks. In addition, organizations need to have visibility beyond their first-tier suppliers – and [research shows](#) that 60% of executives have zero visibility in this respect. In addition, they need to establish KPIs to make comparisons, compute, build insights, and make decisions. Finally, they need to develop mechanisms to collect data with trust.

Blockchain – a key enabler for carbon tracking

Blockchain can help to address these issues. The logic in how blockchain principles apply to carbon tracking is clear. To reduce the carbon footprint of supply chains, companies must be able to collect and track reliable and trusted data accurately and repeatedly.

“ Achieving Net Zero isn't something businesses can do on their own. Working together, and using blockchain technology in their supply chains, they will get further, faster – and with luck, it will help to give the world a happier and more sustainable future.”

Clémence Lambert
Managing Consultant,
Capgemini Invent

By reporting carbon emissions across a blockchain network, they are creating a single platform for carbon measurement, helping to provide a trusted network that can report emissions in an immutable and tamper-proof audit-trail, facilitating connections between all the different participants around a trusted platform that guarantees privacy, security, and traceability. Ultimately, this is all about transparency and accountability between all the supply chain participants.

It's also worth mentioning that private blockchains such as Corda or Fabric, which are the most used for enterprise applications, are quite energy-sober, especially when compared to public blockchains such as Bitcoin or Ethereum. This is mainly due to the difference in the way these protocols validate transactions, in what is known as the consensus method (digital signatures for Corda and Fabric, versus mining for Bitcoin and Ethereum).

Mercedes – a case in point

Mercedes-Benz is working with blockchain start-up Circular on a pilot project for transparency on CO₂ emissions in the cobalt supply chain.

The project will track the emissions of greenhouse gases and the secondary materials in the battery manufacturing supply chains. Additionally, blockchain will be used to ensure all participants follow Daimler's sustainability standards in the supply chain. This is one of the initial efforts for a carbon-neutral supply chain, and Mercedes is working with an undisclosed battery cell supplier for the project.

The project partners are focusing on cobalt procurement, which enters the battery supply chain from recycling facilities. The blockchain will monitor the manufacturing of car batteries and the resultant CO₂ emissions involved in production. Mercedes has said it ultimately wants to create a circular economy.

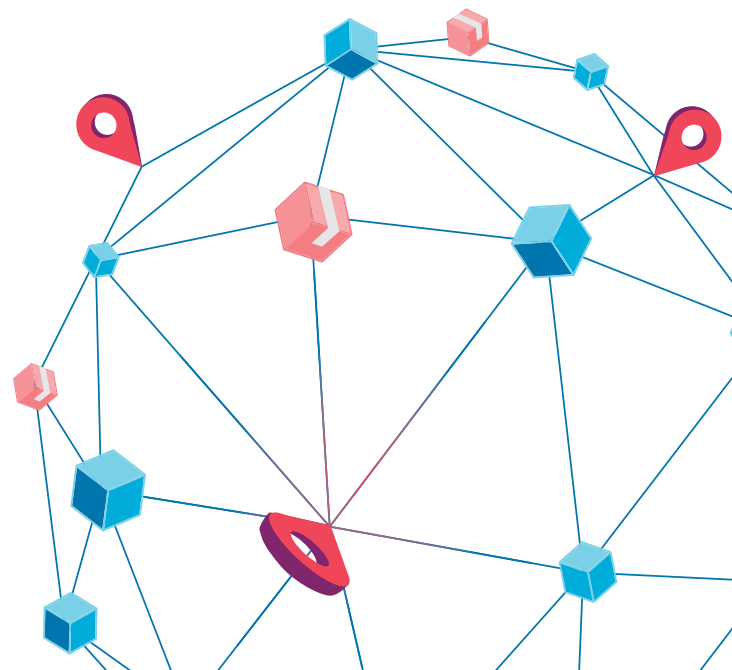
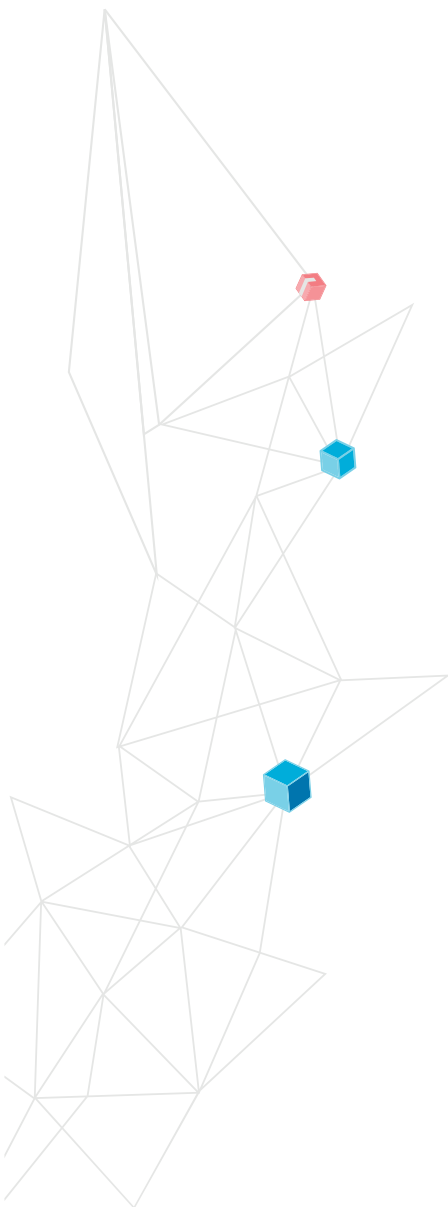
The importance of collaboration

Supply chains are team efforts by their very nature, and interconnectedness is implicit in blockchain, too. Likewise, reducing global carbon levels is something that governments, organizations, and individuals need to work together to achieve.

This is why it's so heartening to see business consortia being formed to tackle the issue. In particular, there is the Climate Chain Coalition (CCC). This is an open global initiative to support collaboration among members and stakeholders to advance blockchain and related digital solutions such as the IoT and Big Data. The aim is to help mobilize climate finance and enhance MRV (measurement, reporting and verification) so as to scale climate actions for mitigation and adaptation.

Achieving Net Zero isn't something businesses can do on their own. Working together, and using blockchain technology in their supply chains, they will get further, faster – and with luck, it will help to give the world a happier and more sustainable future.

[1] Ecoact 2020 Rapport sur la performance en matière de reporting climat des entreprises du CAC 40



Get the **sustainable future** you want



Dr James Robey
VP, Global Head of Sustainability,
Capgemini

The final section of this series of articles looks at the significant sustainability issues that major organizations currently face. In addition to the gradually increasing proliferation of regulatory requirements for businesses to reduce their carbon footprint, there are other strong drivers compelling organizations to increase their actions on sustainability. Not least are the increasing expectations of key organizational stakeholders such as employees (and potential employees), clients, and investors. This pressure is, at last, causing real focus and the beginning of the Sustainable Business Revolution that will be required this decade.

At Capgemini, we are conscious of the need for industry and system level change and consequently our focus goes beyond our internal commitments and extends to a commitment to helping our clients with their sustainability challenges. This was formalized through our target to help our clients save initially 10 million tons of carbon by 2030, with an ambition to go much further.

Internally, Capgemini was one of the first in our sector to set validated science-based carbon reduction targets in line with the need of 2oC climate science (i.e., keeping global temperature increases to no more than 1.5°C above pre-industrial levels). Having delivered these targets, in 2020 the Group set new bolder ambitions including a target to be carbon neutral no later than 2025 and to be net zero by 2030.

By the end of 2020, the Group had set new carbon reductions targets in line with the need of 1.5oC climate science, which once again had been validated by the Science Based Targets initiative (SBTi) and committed to transitioning to 100% renewable electricity through the RE100 initiative. Our 2025 carbon neutrality commitment will involve the compensation for all operational emissions using removal-based carbon offsets, and our net zero commitment will increase the focus across our value chain with all residual emissions compensated.

Technology – the two-edged sword

As a company where technology is integral to the business services we provide, we are very much aware of the sustainability challenges and opportunities that technology itself raises. Technology is a major consumer of electricity and of precious metals, and its use is responsible for significant carbon emissions (by some estimates more than the pre-COVID aviation sector). Consequently, we have a broad focus on the understanding and reducing these impacts through of ways of working. For example, in our Infrastructure Services business, the migration of services to the cloud and the virtualization of servers bring the potential of significant carbon savings, and the latest version of our Integrated Architecture Framework (IAF) includes sustainability considerations at the heart of the methodology.

Whilst the impact of technology is large, it also brings many environmental opportunities. Many of these benefits in terms of remote collaboration and virtual working have been highlighted in this past year with COVID-19 lockdowns impacting a significant proportion of the planet. With these new working patterns, significant carbon savings have been realized in terms of reduced travel. Indeed, estimates by Global e-Sustainability Initiative (GeSI) suggest that by 2030, IT has the potential to cut 9.7 times as many carbon emissions as it produces. This could save around 20% of global carbon emissions by the end of the decade.

At Capgemini, we are looking to deliver these benefits wherever possible both within our own organization and with our clients. In fact, sustainability is at the very heart of the Group, and is captured in our purpose statement that was developed in collaboration with our many stakeholders and with our people at the heart of the process.

Our purpose is to “build an inclusive and sustainable future for all, enabled by technology, drawing on the energy of its talents and also the talents of its customers and partners.” Sustainability is a challenge that goes beyond any single organization, but through collaboration with clients and across sectors, we are working towards that sustainable future.





About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of 270,000 team members in nearly 50 countries. With its strong 50 year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2020 global revenues of €16 billion.

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